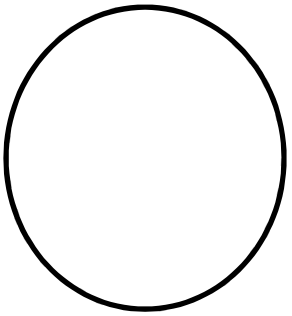
Name _____

Mitosis Simulation

A. Assembly of Original Chromosomes

1. Using 11 red pop beads, assemble your first chromosome by attaching 7 beads together, then the centromere, then the remaining 4 beads
2. Using 10 blue pop beads, assemble your second chromosome by attaching 6 beads together, then the centromere, then the remaining 4 beads
3. Using 9 green pop beads, assemble your third chromosome by attaching 6 beads together, then the centromere, then the remaining 3 beads
4. Using 8 yellow pop beads, assemble your fourth chromosome by attaching 5 beads together, then the centromere, then the remaining 3 beads
5. Draw your original chromosomes in the circle to the right



B. Interphase: DNA Duplication

6. Now begin the simulation of the cell cycle by piling your chromosomes in the nucleus of the Interphase cell
    - Note: At this point of the cell cycle, individual chromosomes cannot yet be distinguished
7. Place 2 centrioles in the space indicated on your diagram
8. Next, duplicate your chromosomes by assembling 4 more identical chromosomes by repeating steps 1-4 above
    - Note: Although there is actually only one centromere between two identical sister chromatids, you will need to use one magnetic centromere for each chromatid in this simulation
9. Draw a diagram in the space to the right to show what your simulated cell looks like before mitosis begins

C. Mitosis: Prophase

The first phase of mitosis is prophase. During this phase, each duplicated chromosome appears as two identical sister chromatids.

10. To simulate this phase, pair up the identical sister chromatids using their magnetic centromeres
11. Then spread the 4 chromosomes apart inside the nucleus of the Prophase cell so the sister chromatids are visible
    - Note: The nuclear envelope begins to break down during Prophase
12. Move the centrioles away from each other as indicated on the diagram
13. Draw a diagram in the space to the right to show what your simulated cell looks like at the end of Prophase

D. Mitosis: Metaphase

The second phase of mitosis is metaphase. During this phase, the chromosomes line up across the center, or metaphase plate, of the cell.

14. Arrange the chromosomes with the centromeres lined up along the equator so that one chromatid is facing one pole while its sister chromatid faces the opposite pole in the Metaphase cell
15. Move the centrioles to opposite ends, or poles, of the cell.
16. Draw a diagram in the space to the right to show what your simulated cell looks like at the end of Metaphase

E. Mitosis: Anaphase

The third phase of mitosis is anaphase. Anaphase begins when the paired centromeres of each chromosome begin to pull apart, separating the two sister chromatids.

17. Using the Anaphase cell diagram, pull apart the sister chromatids of each chromosome and move them toward opposite poles of the cell
    - Note: After the once-joined sister chromatids are pulled apart, each sister chromatid is now considered a full-fledged chromosome
18. Draw a diagram in the space to the right to show what your simulated cell looks like at the end of Anaphase

F. Mitosis: Telophase

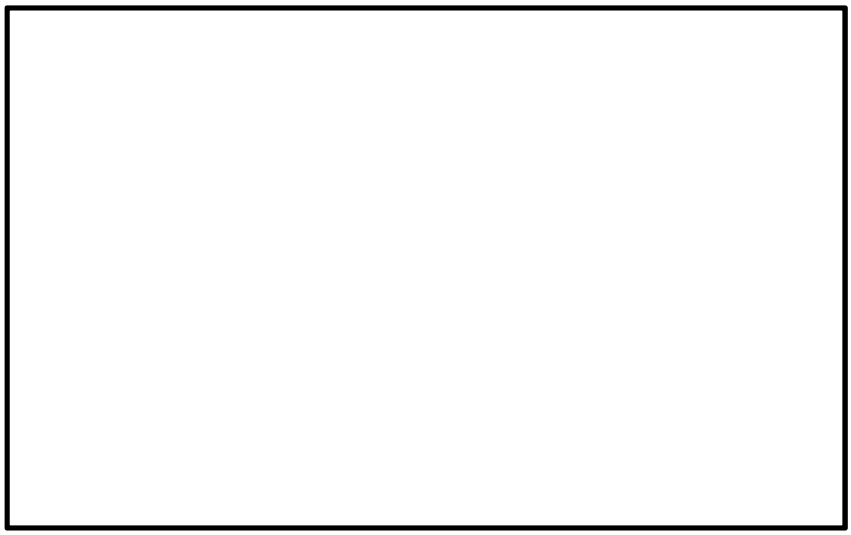
The fourth and final phase of mitosis is telophase. During this phase, daughter nuclei begin to form around the chromosomes that have gathered at the poles of the cell.

19. Pile your simulated chromosomes on each cell pole of your Telophase cell diagram
20. Place your centrioles in the space provided
21. Draw a diagram in the space to the right to show what your simulated cell looks like at the end of Telophase

G. Cytokinesis: Resulting in 2 Daughter Cells

As telophase ends, cytokinesis, the division of the cytoplasm, begins. During this process, two separate daughter cells are produced, shortly after the end of mitosis. In animal cells, the cell membrane moves inward, forming the "cleavage furrow," which separates the dividing cell into two individual but identical cells. In plant cells, a "cell plate" forms along the midline of the dividing cell, eventually dividing the cell into two individual cells.

22. More your simulated chromosomes from each pole to the nucleus of the Daughter cells
23. Place your duplicated centrioles in the space indicated on your diagram
24. Draw a diagram to show what you simulated daughter cells look like at the end of cytokinesis when cell division is complete



Discussion Questions

a) What is the relationship between mitosis and cancer?

b) Why are most spinal cord or nerve tissue injuries permanent?

Analysis Questions

1. What types of cells are formed through mitosis?

2. During what part of the cell cycle are the chromosomes copied?

3. Why do the chromosomes need copied before the cell can divide?

4. What gets divided in mitosis compared to cytokinesis?

5. What is the main difference between cytokinesis in animal vs plant cells?

6. How many daughter cells are produced by a single cell after cell division?

7. How do the daughter cells produced by mitosis compare to each other and the original cell?